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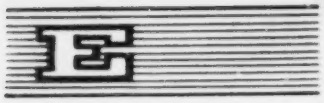

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Addis Ababa, Ethiopia

4 - 8 March 1991

REPORT TO THE JOINT INTERGOVERNMENTAL COMMITTEE ON HUMAN SETTLEMENTS AND ENVIRONMENT ON APPROPRIATE TECHNOLOGY FOR INTERVENTION IN THE PROVISION OF LOW-INCOME SHELTER, INFRASTRUCTURE AND SERVICES IN RURAL AREAS

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I. INTRODUCTION

1. The formulation and implementation of rural settlements development policies in Africa deal, particularly, with the development of social infrastructure such as housing and basic services, whose implementation costs depend essentially on the technology and materials used.

2. The concretization of national housing programmes initiated by member States come up against various socio-economic problems including higher housing demand arising from population increases and increasingly high implementation costs.

3. Moreover, the consumption of building materials has almost doubled in ten years, increasing from $US 40.5 million in 1975 to $US 75 million. The cost of building material imports amounts to $US 3 billion or about half the food import bill.

4. This situation has an adverse impact on the production of housing for the low-income rural population, who are generally handicapped by the unavailability of local building materials and high cost of imported products such as portland cement, corrugated iron and asbestos sheets whose selling price in most African countries make up as much as 70 per cent of the cost price of economical housing.

5. Furthermore, although the construction industry accounts for four to 11 per cent of the GDP of member States and building materials for 60 per cent of the value of the sector, the efforts made by Governments to house the majority of the people remain limited, particularly because the opportunities offered by local technologies are insufficiently developed and the natural resources available in the region are exploited only to a limited extent.

6. In this connection, numerous studies have been undertaken, particularly by ECA, underscoring the importance of a policy on the development of local materials based on the design and popularization of appropriate local technologies and on the increased supply of economical products.

7. Putting such a process into effect would promote the substitution of local production for imports, thereby leading to foreign exchange savings and investment in other equally strategic development sectors. As such, this report examines the most pertinent parameters in the development of appropriate technologies for providing low-cost housing and basic services and developing low-cost infrastructure in the rural areas.

8. The measures recommended relate mainly to the establishment of a process for increased local materials production, based on maximum integration of the small-scale enterprise sector in the

African market, standardization of equipment and products as well as the development of a promotional plan aimed at increasing awareness of and generalization in the rural areas of stabilized earth blocks, lime, tiles and burnt clay blocks and fibre cement blocks produced from such natural resources as clay, pozzolana, dolomite and other residues, mainly agricultural.

II. THE BASIS OF A LOCAL BUILDING MATERIALS POLICY

9. The potential demand and availability of mobilizable natural resources are two major factors favouring the adoption of a local building materials development policy.

1 Demand for materials

10. In the absence of precise data on building material needs in the region, observation of the general trend in the use of certain products in many countries has shown that demand is much higher than current supply.

11. Burnt earth bricks are used widely in the construction of public and private structures particularly in Ghana where annual consumption is 12.3 million units and in Nigeria where consumption increased from 41.61 million in 1982 to 74.48 million units in 1986.

12. Stabilized earth blocks are also widely used in Uganda, Madagascar, Zambia and Mali. The success of the sisal fibre concrete roofing sheets in the implementation of rural housing programmes has led to a higher demand for the product.

2. Mobilizable natural resources

13. The fact that the natural resources necessary for the production of building materials are available locally is borne out FAO research work (table 1), despite the lack of precise information on actual capacities and technical specificities of these resources.

Recommendations

14. The local production of the materials necessary for carrying out rural programmes should be integrated into a national building materials development strategy

15. Demand for local materials in the rural areas should be assessed so as to develop a production process suited to needs and to the existing capabilities that could be mobilized to implement rural housing programmes.

16. Projects for the prospection and analyses of raw material deposits in the rural areas should be developed so as to evaluate accurately their physical and chemical properties compared to the technical specificities required for their use in rural housing programmes (situation, conditions of access and exploitation, yield, purity, resistance, etc.)

17. A structure should be established at the national level for promoting and co-ordinating the activities of firms and institutions concerned with the production of local building materials meant for rural housing programmes.

Table 1: Availability of local raw materials

Country	Limestone Dolomite Gypsum Pozzolana	Sand Gravel Sandstone Other stones	Clay laterite	Agricultural, mining and industrial wastes
Burkina Faso	A	A	A	L
Burundi	M	M	A	S
Cape Verde	M	S	M	S
Cameroon	M	A	A	S
Gambia	S	M	A	M
Ghana	L	A	A	M
Côte d'Ivoire	S	A	A	M
Kenya	S	A	M	M
Lesotho	M	A	M	S
Liberia	S	A	A	M
Madagascar	A	M	A	A
Mauritania	L	M	S	S
Niger	A	A	A	S
Nigeria	S	A	A	A
Uganda	A	A	A	A
Central African Rep.	L	A	S	S
Rwanda	M	A	A	S
Sierra Leone	S	A	A	A
The United Republic of Tanzania	A	M	A	A
Togo	A	A	A	A
Zambia	M	A	A	A

Abundant (A)
Moderate (M)
Limited (L)
Scarce (S)

Source: FAO - State of the art in building materials, African region 1984.

III. TECHNOLOGIES

18. Existing technologies that could be exploited in carrying out rural housing programmes relate to the production of local materials for raising walls, manufacturing binders and constructing roofs.

1. Walls

19. Burnt clay bricks and stabilized earth blocks are among the most common and most suitable materials for wall construction in Africa.

20. Burnt clay bricks are manufactured as much in East Africa as in West Africa. Research is under way on the design of efficient kilns for increased fuel efficiency, alternative sources of energy so as to reduce the effect of tree felling on the environment and the introduction of bricks of bigger dimensions (as in the case of 290/140/100 bricks in Nigeria) in order to increase productivity.

21. Stabilized earth blocks have recently become popular because of their many advantages. Their production is not dependent on the availability of clay and is very economical on fuel. Moreover, the only equipment necessary is the manual or mechanical press, both of which can be manufactured locally.

22. However, the standardization of this product is still hampered by the question of optimal rate of stabilizing agent necessary (lime or cement) depending on the qualities of the earth used. This is a problem for which Côte d'Ivoire and Togo have adopted some recommendations and directives.

23. The physical qualities and financial implications of these materials should, however, be enhanced by developing economical protective coatings manufactured from widely available products.

2. Binders

24. Lime and pozzolana which were widely used in the past are still more economical than cement, despite their limited production due to insufficient knowledge mainly of their advantages.

25. The production of lime from calcium and dolomite makes it possible to manufacture binders, stabilizing agents and distemper for various uses.

26. The development of this material should, however, be supported by the development of efficient kilns and better-controlled baking

methods, particularly in conjunction with the use of simple measurement equipment.

27. Natural or artificial pozzolana may be used for the manufacture of pozzolanic cement, which is already relatively widespread in Ethiopia, Rwanda, Cameroon and Burundi.

28. Lime and pozzolana mixtures which are currently being researched will make for 20 percent to 40 percent savings on cement in the manufacture of medium and low quality concrete.

29. Natural pozzolana of volcanic origin is widespread in many countries including Burundi, Cameroon, Cape Verde, Ethiopia, Kenya, Madagascar, Malawi, Uganda, Rwanda, Senegal and the United Republic of Tanzania.

30. Artificial pozzolana referred to as organic pozzolana is manufactured from the controlled burning of vegetable wastes (rice, coffee and groundnut husks and sugar cane bagasse) and inorganic pozzolana from calcinated rocks, clay and bauxites.

3. Roofing materials

31. Burnt clay tiles and fibre cement sheets are two viable roofing materials in terms both of technology and finance. The cost of these materials in Malawi in 1987 were $US 2.25 and $US 1.75 per/$m^2$ respectively as against $US 8.71 for corrugated iron sheets.

32. The production of burnt clay tiles has been mastered in many countries. The material should, however, be refined through improvement of the quality of the clay used and in more finer mixing so that it can last longer than the current ten years.

33. The use of burnt clay tiles requires roof structures capable of supporting from 30 to 50 kg/m^2.

34. There has been substantial progress in the production of fibre cement tiles, particularly in East Africa during the past decade. Research on vegetable fibre mixtures (sisal, coconut), lime, pozzolana, and sand with a low cement content is providing new opportunities for the development of a still more economical product.

35. Moreover, research is also under way in Malawi on the manufacture of manual vibrating tables in order to offset the relatively high cost of battery charging.

Recommendations

36. Research into the artisanal and industrial manufacture of such high-performance equipment, as concrete mixers, incinerators, stone crushers, vibrating tables and presses should be encouraged.

37. Research into the development of alternative economical sources of energy for the production of local building materials should be promoted.

IV. PRODUCTION OF LOCAL BUILDING MATERIALS

38. The implementation of local building material development policies requires the establishment of a production process based of making the activities of both the formal and informal sectors profitable on the one hand, and assessing the capacities of various enterprises to provide high-performance and low-cost products in the rural areas, on the other.

1. Scale of production

39. The big mechanized factories particularly in the industrial areas or near the big urban centres have not been able to efficiently meet the building material needs of the rural population because they are highly expansive to acquire mainly as a result of their high import content and transport costs.

40. The production of local building materials in the informal sector has many advantages such as the ease of siting operations close to where the materials are available and the relatively low investments required, affordable by small-scale entrepreneurs as well as products cost prices often within the means of low-income groups.

41. The impact of this sector on the increased supply of efficient local materials remains limited because of the random nature and often mediocre quality of production due generally to the empirical approach to activities and poor knowledge of the needs of the market.

42. Production in the sector should, therefore, be enhanced through support actions aimed at improving the manufacturing process and adapting the rate of production to the needs of the local market.

43. Small-scale industrial production has many advantages that may well increase the supply of local building materials in the rural areas.

44. Small production plants can develop local manufacturing technologies and can be more easily established in accordance with the availability of basic products and demand.

45. Besides, the flexible management of small enterprises coupled with better control of the manufacturing process and lower transport costs make for better quality products and relatively lower cost prices.

46. Furthermore, compared to the large-scale automated plants, the production cost per worker in small plants are 20 times lower with only 15 per cent import content (as against 75 per cent in the larger plants) and has employment potential for twenty times more labour.

47. The small-scale production of local building materials therefore offers the most advantages in view of the realities of the rural building sector, namely disparate markets, low wages, employment problems, scarce foreign exchange as well as insufficient industrial equipment and infrastructure.

Recommendations

48. A network of small-scale industrial plants should be developed in the rural areas to produce building materials locally in accordance with the location of raw materials and demand so as to reduce losses during movement from place to place and travel costs.

49. Informal sector activities should be supported by research into local materials available to the sector so as to enable it to improve the quality of its production and to provide it information on local market needs so that manufacturing rates can be adapted accordingly.

2. Manufacture of the equipment necessary for production

50. The viability and autonomy of local building materials production are also dependent on the possibilities of ensuring the manufacture locally of the equipment, materials, tools and spare parts necessary for the installed technological facilities and their continuous operation.

51. This requires the accordance of priority to national-level activities by all the relevant structures such as training centres, manufacturing plants, engineering workshops, service companies and production units and contribution to the design of prototypes and manufacture of equipment in larger quantities.

52. Thus, the institution of a local building materials production process should include an evaluation of the capacities of all

sectors to locally produce the equipment required to meet their installed technological facilities and a medium- and long-term programme aimed at the development of these facilities in accordance with the objectives of rural housing programmes.

Recommendations

53. An assessment should be conducted of rural potential for the manufacture of the equipment, tools, materials and spare parts necessary for the production of local building materials and a medium- and long-term programme for the development of the identified capacities instituted.

54. Training institutions should be given the responsibility of designing prototypes of local building materials production equipment and concessionary fiscal measures taken to promote public and private investments for their production.

3. Standardization of production and institution of codes and regulations

55. Regional conferences on building materials have recommended the standardization of production and the institution of building codes for the purpose of promoting increased production, expansion of markets and better acceptance of building materials by the public and various users.

56. Research on standardization should be conducted on the basis of laboratory studies and field experiences in the implementation of rural housing programmes, so as to adapt the technical specifications to local realities.

Recommendation

57. Activities for the standardization of local building materials production should be developed and regulations drafted on the technical specifications and use of products.

4. Energy for production

58. Building materials production plants consume large amounts of energy (fuel and electricity) and firewood is the main source of energy in rural areas.

59. Production plants located in rural areas therefore face difficulties in energy supply because of poor service to their localities, the absence of energy infrastructure and the scarcity of firewood.

60. As such, the establishment of a process for the production of building materials, should constantly take account of the needs of plants located in the rural areas for energy.

Recommendations

61. Mini hydro-electric power plants should be constructed in rural areas having adequate rainfall and river networks.

62. Solar-powered technologies for the production of building materials should be developed and applied.

63. Such agricultural residues rice husks, bagasse, groundnut shells and sawdust should be used as fuel.

64. Plans should be formulated for the reforestation of affected areas with fast-growing species.

V. PROMOTION OF LOCAL BUILDING MATERIALS

65. The lack of political will for enhancing traditional techniques and the fact that research findings are not publicized, has combined with the conservative attitude of various users, to cause the stagnation, if not actual decline, of the use of local products in the implementation of public programmes, particularly self-help construction in rural areas.

66. The development of building materials, therefore, requires promotional support aimed at government services, the informal sector and the public in order to reinstitute production traditions at various levels and restore confidence in the use of such materials in the implementation of rural programmes.

67. The local building materials development process should include a promotional plan comprising a credit policy, a training and assistance programme for production enterprises, the launching of information campaigns and extension services as well as the development of research work.

1. Credit policy

68. The institution of a credit policy for the production of low-cost housing should promote access to housing credit for the low-income population, on the one hand and provide financial support for public and private enterprises engaged in the production of local building materials in the rural areas, on the other.

69. As such, the intervention of the public authorities should consist in guaranteeing the creditworthiness of individual rural builders who pose a relatively higher risk vis-a-vis the credit

institutions. They should also pressurize the financial institutions to reconsider the terms for granting loans to enterprises producing local building materials in the rural areas. In Zambia, the commercial rate charged by the Small Industries Development Organization (SIDO) is 15 per cent and the contribution of the applicants to the investment capital also about the same percentage.

Recommendations

70. Efforts should be made to promote the participation of the public and private enterprises in the establishment of local building materials production plants in the rural areas and institute flexible and concessionary procedures for obtaining credit and distributing land for the installation of such plants.

71. Efforts should be made to promote savings and support individual builders to obtain housing credit from the financial institutions for constructing family dwellings in the rural areas.

2. Establishment of training programmes

72. Many African institutions provide various levels of vocational and handicrafts training in building technology. Such programmes focus on the study and use of conventional building materials such as Portland cement and steel.

73. All these structures can potentially be adapted to meet the national training requirements in technical specifications and the use of local products.

Recommendations

74. Training structures and programmes should be adapted or established to cover all the skills necessary in the local building materials developing process, in accordance with the staff needs identified within the production units and rural enterprises.

75. Private entrepreneurs should be trained in the technology and management of local building materials production plants.

3. Institutional support to enterprises

76. Special attention should be paid to the supervision of public enterprises and informal sector firms in order to consolidate and promote their contribution to local building materials development.

77. This task which is mainly the responsibility of the public departments concerned with the promotion of local building

materials, may require appropriate structures being established to assess the production units, particularly in formulating administrative procedures, preparing applications for financing, conducting market and feasibility studies, training staff and monitoring the implementation of projects.

Recommendations

78. Efforts should be made to establish or strengthen the public structures responsible for assisting enterprises in the formal sector and those in the rural informal sector in order to ensure efficient functioning of their local building materials production and promotion activities.

4. Development of information and extension services

79. To date, the publishing of materials and advertisements has been confined to a few operations initiated by research bodies or isolated producers despite their importance to the development of local building materials.

80. The intervention of the government departments in this regard should be to promote the publication of practical manuals for the general public. It is also necessary to support and co-ordinate intensive advertisement campaigns on building materials produced locally by rural enterprises.

Recommendations

81. Efforts should be made to support the publication of practical manuals and to promote campaigns publicizing local building materials among the various users in the rural areas.

82. To generalize the use of local building materials in implementing rural programmes financed from state and local community budgets.

5. Development of research

83. The production of local materials should be bolstered on a continuing basis by research on the improvement of the performance of the products used in the past such as lime or stabilized earth blocks and the identification of new products.

84. Research activities can also cover the standardization of products and equipment and the adaptation of production to the climatic conditions in given areas.

85. The impact of research on the local building materials process could also be examined through popularization of the findings in the form of technical publications, expert and consultancy services

to small enterprises and the implementation of demonstration projects in the rural areas.

Recommendations

86. Research on the development of local building materials should be promoted and the findings applied in the implementation of rural demonstration projects and programmes.

87. A national fund for research into the development of local building materials should be established using state funds and assistance from industries, production units and enterprises.

At the regional level:

88. Subregional structures should be established to co-ordinate and develop exchange of information and experiences among research institutions in various African countries in order to avoid duplication of efforts and rationalize the use of available resources.

At the international level:

89. The sources of financing for the development of research and implementation of pilot projects in local building materials should be strengthened.

VI. INTEGRATED RURAL HOUSING POLICY

90. The formulation and implementation of strategies for economical and viable housing production in the rural areas should take account of the land question, the modalities for supplying building materials and the establishment of basic equipment and infrastructure.

1. The land question

91. Plots of land on which dwellings can be constructed are non-renewable scarce resources. As such, land generally constitutes a major constraint in the construction of family houses for the low-income groups.

92. In the production of housing for the rural population, it is therefore necessary to delimit and to constitute land reserves for implementing rural programmes, in accordance with existing regulations on land use in the area concerned.

93. The process of constituting land reserves comprise among other things, the search for and acquisition of appropriate sites, the

conduct of engineering studies and the definition of modalities for building, managing and maintaining communal infrastructure.

Recommendations

94. Land development procedures should be so formulated as to reflect national objectives on land use in the rural areas.

95. When delimiting and constituting rural land reserves for rural programmes, a close relationship between future housing estates, cultivated land and agriculture related amenities should be secured.

96. Preferential price scales should be established for rural housing and equipment programmes.

2. Promotion of rural housing

97. The launching of housing operations in rural areas aims at increased mobilization of all existing potential so as to strengthen the means of action and to consolidate the contribution of the State in carrying through rural housing programmes.

Recommendations

98. Efforts should be made to strengthen or to establish public structures responsible for prospecting appropriate sites and acquiring land for building, conducting engineering studies and developing building sites for rural housing programmes.

99. Rural housing should be promoted by granting building land for rural housing programmes involving the use of local materials on pre- ferential terms.

100. The implementation of rural housing programmes financed on state budget should be assigned to public and private enterprises on the basis of agreements and technical specifications involving the use of local building materials.

101. The formation of rural co-operatives or village associations should be promoted to carry out self-help housing and equipment programmes using local materials in particular and benefitting from technical assistance and logistical support in the supply of materials.

3. Supply of local building materials to rural areas

102. Deficient transport infrastructure and difficulty of access generally constitute a major obstacle to the implementation of housing schemes in the rural areas.

103. As such, any strategy aimed at providing economical housing should include the establishment of a supply and distribution circuit for building materials going to the rural areas, particularly to mountainous and landlocked regions.

104. Supply and distribution centres classified in a hierarchical order, namely primary, secondary and tertiary could be established in accordance with the location of work sites, building materials production plants and the centres of real or potential demand.

Recommendation

105. A supply and distribution network for local building materials should be organized for the rural areas, giving priority to landlocked or mountainous localities.

4. Establishment of housing-related amenities

106. Rural housing programmes should also include the establishment of the amenities necessary in housing estates, namely health, education, trade, services, administration and telecommunications and transport facilities.

107. The technologies identified for producing low-cost housing could also be applied in the provision of the above-mentioned amenities.

108. This will make it possible to develop the local building materials market and promote the building of such infrastructure as will raise standards in the rural areas.

109. Besides, the integration of such amenities in the design of the standard architectural and engineering plans for project sites makes for a substantial reduction in the cost price of the above services and also for savings on the time they take to implement.

Recommendation

110. The establishment of housing-related amenities using local building materials should be included in rural housing programmes on the basis of architectural and engineering studies reflecting the realities of project sites.

5. Establishment of rural networks

111. The technologies for providing basic infrastructure at low cost relate to the modalities for establishing public highway, water supply, solid and liquid waste disposal and electrification networks.

(a) Public highways

112. The construction of public highways is an essential factor in the opening up, organization and management of rural settlements. The public highways network is designed in accordance with various traffic and interconnection needs identified for pedestrians, cycles, carts, agricultural machinery, vehicles and adapted to the geo-climatic conditions of the region.

Recommendations

113. Efforts should be made to design and construct with local materials (stones, tuff, sand, etc.) a network of various grades of public highways in accordance with the road safety rules, ensuring that they are passable during the rainy season.

114 Rural highway projects should be co-ordinated with the establishment of drinking water supply, sanitation, rain water drainage and electrification networks so as to rationalize the use of available resources and prevent repetition of work.

115. Structures should be identified for the establishment and maintenance of rural highways and legislation drafted on the modalities for concluding agreements between the various partners.

(b) Drinking water supply

116. The criteria to be taken into account in the choice of technology are:

- The possibility of manufacture locally using available materials;
- The resistance of parts to wear and atmospheric conditions;
- Standardization by adapting a limited number of models so as to facilitate maintenance and training of local managers;
- Simple maintenance methods that can be easily applied by the village technicians responsible for the task;
- Production level suited to needs so as to avoid wastage of water resources.

(c) Disposal of solid and liquid wastes

117. Sanitation techniques suited to rural areas with small populations are:

- Pit latrines;
- Ventilated and improved pit latrines;
- Ventilated and improved double pit latrines;
- Odourless earth closets;
- Water closets;
- Septic tanks.

118. The shallow sewerage system is a possible technological option particularly for settlements with densities in excess of 160 inhabitants/ha. This relatively recent system holds much prospects because of the quality of service and its low price, despite the water consumption of 25 litres/inhabitant/day necessary for its operation and maintenance.

119. The establishment of rainwater disposal facilities is often neglected in rural settlements. These, however, have a major role in ensuring the viability of constructed works, in preventing floods and in the maintenance of highways and the general condition of hygiene in these areas.

Recommendations

120. Public departments should prepare development studies and carry out primary and secondary infrastructure in rural settlements, with the rural population taking responsibility for the maintenance of tertiary networks.

121. Rain water should be evacuated through a network of stabilized earth gutters along the various roads in rural settlements.

122. Each village should organize a system of collection solid wastes and disposing of them by animal or mechanical traction into a common pit managed by the authorities.

(d) Rural electrification

123. The design and establishment of the rural electrification network should be based mainly on research on economical energy sources.

124. The possible technological options for low-cost energy production in rural areas are:

- Use of solar energy;
- Biogas systems;
- Charcoal plants;
- Diesel generators;
- Hydro-electric power plants.

VII. ANNEX 1: SUMMARY OF RECOMMENDATIONS

I. THE BASIS OF A LOCAL BUILDING MATERIALS POLICY

Efforts will need to be made

125. To integrate the local production of the materials necessary for carrying out rural programmes into a national building materials development strategy.

126. To assess the demand for local materials in rural areas in order to develop a production process suited to needs and to the existing capabilities that could be mobilized to implement rural housing programmes.

127. To develop projects for the prospection and analyses of raw material deposits in the rural areas so as to evaluate accurately their physical and chemical properties compared to the technical specificities required for their use in rural housing programmes (situation, conditions of access and exploitation, yielding, purity, resistance, etc.)

128. To establish a structure to be responsible at the national level for promoting and co-ordinating the activities of firms and institutions concerned with the production of local building materials meant for rural housing programmes.

II. TECHNOLOGIES

129. To encourage research on artisanal and industrial manufacture of high-performance equipment, particularly travel plants, incinerators, finishing mills, vibrating tables and presses.

130. To promote research into the development of alternative economical sources of energy for the production of local building materials.

III. PRODUCTION OF LOCAL BUILDING MATERIALS

131. To develop a network of small-scale industrial plants in the rural areas to produce building materials locally in accordance with the location of raw materials and demand so as to reduce losses incurred during movement from place to place and travel costs.

132. To support informal sector activities by making research on local materials available to the sector to enable it to improve the quality of its production and to provide it information on local market needs so that the manufacturing rates can be adapted accordingly.

133. To assess the potential in rural areas for the manufacture of the equipment, tools, materials and spare parts necessary for the production of local building materials and institute a medium- and long-term programme for the development of the identified capacities.

134. To entrust training institutions with the responsibility of designing prototypes of local building materials production equipment and promote public and private investments for their production through concessionary fiscal measures.

135. To develop activities for the standardization of local building materials production and formulate legislation on technical specifications and use of products.

136. To construct mini hydro-electric power plants in rural areas having adequate rainfall and river networks.

137. To develop for and apply solar-powered technologies to the production of building materials.

138. To use agricultural residues such as rice husks, bagasse, groundnut shells and sawdust as fuel.

139. To formulate plans for the reforestation of affected areas with fast-growing species.

IV. PROMOTION OF LOCAL BUILDING MATERIALS

140. To promote the participation of the public and private enterprises in the establishment of local building materials

production plants in the rural areas and institute flexible and concessionary procedures for obtaining credit and distributing land for the establishment of such plants.

141. To promote savings and support individual builders to obtain housing credit from the financial institutions for constructing family dwellings in the rural areas.

142. To adapt or establish training structures and programmes covering all the skills necessary in the local building materials developing process, in accordance with the staff needs identified within the production units and rural enterprises.

143. To promote the training of private entrepreneurs in the technology and management of local building materials production plants.

144. To establish or strengthen the public structures responsible for assisting enterprises in the formal sector and those in the rural informal sector to ensure efficient functioning of their local building materials production and promotion activities.

145. To support the publication of practical manuals and promote campaigns publicizing local building materials among the various users in the rural areas.

146. To generalize the use of local building materials in implementing rural programmes financed from state and local community budgets.

147. To promote research on the development of local building materials as well as the application of the findings in the implementation of rural demonstration projects and programmes.

148. To establish a national fund for research into the development of local building materials from state budget with assistance from industries, production units and enterprises.

At the regional level:

149. To establish subregional structures responsible for co-ordinating and developing exchange of information and experiences among research institutions in various African countries in order to avoid duplication of efforts and rationalize the use of available resources.

At the international level:

150. To strengthen the sources of financing for the development of research and implementation of pilot projects in local building materials .

V. INTEGRATED RURAL HOUSING POLICY

151. To formulate development procedures in accordance with national objectives on land use in the rural areas.

152. To delimit and constitute land reserves in the rural areas for carrying out rural programmes by ensuring close relationship between future housing estates, cultivated land and agriculture related amenities.

153. To establish preferential price scales for the transfer of land meant for rural housing and equipment programmes .

154. To strengthen or to establish the public structures to be responsible for prospecting appropriate sites and acquiring land for building, conducting engineering studies and developing building sites for rural housing programmes.

155. To promote rural housing by granting building land for rural housing programmes involving the use of local materials on preferential terms.

156. To assign the implementation of rural housing programmes financed on state budget to public and private enterprises on the basis of agreements and technical specifications involving the use of local building materials.

157. To promote the formation of rural co-operatives or village associations to carry out self-help housing and equipment programmes using local materials in particular and benefitting from technical assistance and logistical support in the supply of materials.

158. To organize a supply and distribution network for local building materials meant for the rural areas, giving priority to landlocked or mountainous localities.

159. To include the establishment of housing related amenities using local building materials in rural housing programmes on the basis of architectural and engineering studies appropriate to the realities of project sites.

160. To design and construct with local materials (stones, tuff, sand, etc.) a network of various grades of public highways in accordance with the road safety rules, ensuring that they are passable during the rainy season.

161. To co-ordinate the rural highway projects with the establishment of drinking water, sanitation, rain water drainage

and electrification networks so as to rationalize the use of available resources and prevent repetition of works.

162. To identify the structure(s) responsible for the establishment of rural highways and those responsible for their maintenance and prepare legislation on the modalities for concluding agreements between the various partners.

163. Public departments should prepare development studies and carry out primary and secondary infrastructure in rural settlements, with the rural population taking responsibility for the maintenance of tertiary networks.

164. To evacuate rain water through a network of stabilized earth gutters along the various roads in rural settlements.

165. To organize a system of solid waste collection at each village and to dispose of them by animal or mechanical traction to a common pit managed by the authorities.

ANNEX

Table 1: Field of activity of research institutions.

Table 2: Suitability of laboratory equipment for building materials research.

Table 3: Major accomplishments of research institutions.

Table 4: Training programmes of research institutions.

Source: UNECA - Review of capacities of research and development institutions in Africa - March 1988.

1. FIELD OF ACTIVITY

Institution (country)	Adobe Stablized earth	Lime	Pozzolana Nat./Art.	Rice Husk ash	Burnt brick	Clay tile	Fibre-cement sheet/tile	Lime-Pozzolana (cement)
ETHIOPIA Materials Research and Services Department (MRSD)	X							
GHANA Building & Road Research Institute (BRRI)	X	X	X	X	X	X		
KENYA Housing Research & Development Unit (HRDU)	X						X (Also Kenyata University College)	
MADAGASCAR Laboratoire National des Travaux Publics et du Bâtiments (LNTPB)	X	X	X	X	X		X	
NIGERIA Nigerian Building & Road Research Institute (NBRRI)	X	X		X		X	X	X
RWANDA Laboratoire de Génie Civil (LGC)		NO	INFORMATION					
SENEGAL Centre Expérimental de recherches et d'études pour l'équipement (CEREEQ).	X	X	X	X	X			X
TANZANIA National Housing and Building Research Unit (CERREU)	X	X	X		X		X	X
TOGO Centre sous-régional de recherche sur les matériaux de construction et le bâtiment (CERREM)	X	X		X	X			

2. SUITABILITY OF LABORATORY EQUIPMENT FOR BUILDING MATERIALS RESEARCH

Research Institution	Stabilished Earth	Lime	Pozzolana	Rice husk	Brick	Fibre Cement sheet
ETHIOPIA (MRSD)	A	-	-	-	-	-
GHANA (BRRI)	A	A	B	B	A	-
KENYA (1) (HRDU)			(See the footnote)			
MADAGASCAR (LNTPB)	A	A	A	A	A	B
NIGERIA (NBRRI)	A	A	A	A	B	B
RWANDA (IGC)	B	B	B	-	B	-
SENEGAL (CERERQ)	A	A	A	A	B	-
TANZANIA (NHBRU)	A	A	A	A	A	A
TOGO (CERER)	A	A	B	B	B	-

Note : "A" means equipment is suitable for major research
"B" means equipment is suitable for minor research and testing

(1) HRDU shares laboratory facilities with the Faculty of Engineering at the University of Nairobi. The existing laboratories are equipped to carry out research and testing work on building materials including soil, cement and concrete, clay products and ceramics.

3. MAJOR ACCOMPLISHMENTS OF RESEARCH INSTITUTIONS

Country/ Institution	Major Achievements	Application of Research Findings (pilot plants, etc.)
ETHIOPIA HRSD(MUDH)	Development of building blocks from pumice, lime and gypsum.	Prototype houses built with compressed earth bricks, PKG blockets and hollow concrete blocks on black cotton soil.
GHANA (BPRI)	Design of brick and lime kilns. Comprehensive evaluation of lateritic soils and pozzolanic materials	Setting up of pilot plants. Two brick pilot plants were later handed over to entrepreneurs. Construction of prototype houses in brick and timber. Consutancy and training.
KENYA (HRDU)	-	Transfer of research findings on appropriate building materials and technologies to rural communities to improve their built environment. Construction of demonstration buildings in local materials.
MADAGASCAR (LNTPB)	Evaluation of limestone deposits. Lime stabilization for road construction.	Assistance to production units for fibre-cement tiles, lime, cement, bricks(quality control).
NIGERIA (NBRRI)	Design and fabrication of block making machine. Design and construction of vertical shaft kiln for lime production of table for manual production of roofing sheet from coir.	Used block machine to produce cement stabilised blocks for construction of prototype house. Pilot project on model village using local materials.
RWANDA (LGC)	-	-

Country/ Institution	Major Achievements	Application of Research Findings (pil plants, etc.)
SENEGAL (CRREEQ)	Exposure test results on stabilised soil walls covering period of over 30 years which have proved their long-term durability.	Popularization of stabilised soil block constructions.
TANZANIA (NHBRU)	Improvement of lime kiln. Introduction of brick making technology, improvement of field clamps. Introduction of fibre reinforced cement sheet technology. Introduction of pozzolime and pozzocement in Tanzania. Participated in design of improved block press.	Field demonstration of materials production and utilization technology. Large-scale production plant for sisal fibre reinforced cement sheets has been established. Distribution of publications, some in local languages. Consultancy and training.
TOGO (CERSIA)	Design and construction of kilns for producing lime and burnt bricks.	Established production units for lime and burnt bricks. Technology for lime production has been transferred to a local entrepreneur. Stabilised soil technology has been promoted through its use in construction of houses and other buildings. Consultancy and training.

4. TRAINING PROGRAMMES OF RESEARCH INSTITUTIONS

Country/ Institution	Type of training offered
ETHIOPIA HRSD(MUDH)	-
GHANA (BRRI)	6 weeks brick technology course for technicians (A). Training courses in lime production (B). Courses in building construction management (C).Materials testing and standardization (C).
KENYA (HRDU)	The unit provides service teaching to the Departments of Architecture, Land Development, Urban and Regional Planning in the University of Nairobi (A). Training of rural communities in the production and utilization of local building materials (A).
MADAGASCAR (LNTPB)	Stabilised soil technology (C). Burnt bricks (C).
NIGERIA (NBRRI)	Train the trainers programme on use of local materials such as bricks, coir fibre corrugated roofing sheet as part of programme drawn up by the Directorate of Food, Roads, and Rural Intrastructures, 3 weeks per course for the 19 States of Nigeria (A).
RWANDA (LGC)	The laboratory provides technical support for the training of graduate civil engineers (A).
SENEGAL (CERERQ)	Courses planned in stabilised soil technology and materials testing (B), courses on lime, plaster and pozzolana could be offered if there is a demand (C).

Country/ Institution	Type of training offered
TANZANIA (NHBRU)	Local building materials production (A). Materials testing (A). Building technology (A). Building design (B). Building regulations (C)
TOGO (CERFM)	Courses for masons (A), Carpenters (A), health inspections (A), draughtsmen (A), engineers (C), architects (C), students (C).

Note: "A" means "on-going"
"B" means "planned"
"C" means "possible if demanded"

BIBLIOGRAPHY

1. Infrastructure development for upgrading rural settlements and improving rural living standards (E/ECA/HUS/40), December 1988.

2. Role of small-scale building materials industries in the implementation of human settlements development programmes and rural development projects in the African region (E/ECA/HUS/42), December 1988.

3. Guidelines for the development of appropriate building materials production for low-cost housing construction (E/ECA/HUS/39), September 1988.

4. Appropriate design and applied technologies for the development of human settlements infrastructure in Africa (E/ECA/HUS/41), November 1988.

5. State of the art of local building materials in Africa (E/ECA/HUS/31), April 1986.

6. Thoughts on a human settlements policy in Africa: the land problem in urban areas and housing programmes for the masses (E/ECA/HUS/12), May 1985.

7. Planning of decentralized production systems (E/ECA/HUS/14), June 1983.

8. The development of decentralized systems of building materials production in African countries (E/ECA/HUS/13), January 1985.

9. Regional Seminar on Spontaneous and Low-Cost Housing, Addis Ababa, Ethiopia, 18 to 21 November, 1985.